MUTUAL ORIENTATION SYSTEMS

A. Magnetic Azimuth Method

1. Equipment

(a) Map

(b) Protractor

(c) Magnetic Compass

(d) Knowledge of Magnetic declination

2. Procedure

(a) Select positions to be occupied on map.

(b) Determine magnetic declination either from available tables, maps, or charts.

(c) Draw true meridian through each position on map.

(d) Draw line on map connecting the two positions. Fig. 1.

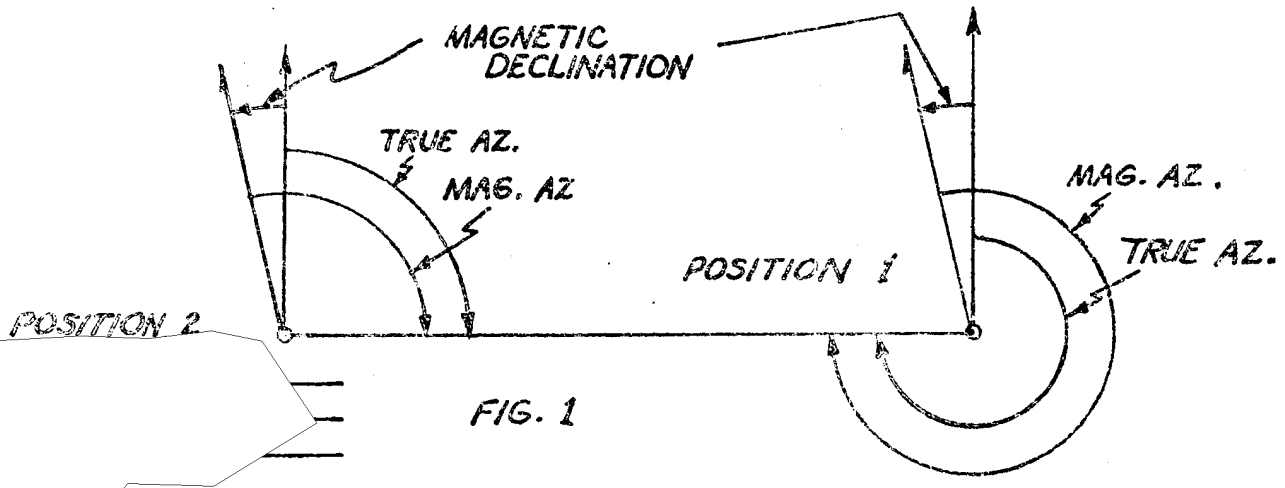

FIG. 1

25X1

(e) On the map measure clockwise the angle between true north and the line connecting the two positions. A protractor can be used for this purpose

25X1

25X1

(f) The angle measured with the compass is the angle between magnetic north and the line connecting the two stations. This should be equal to the true azimuth obtained from the map ± the ma getic declination.

(g) The procedure assumes no magnetic attraction of the instrument. It is assumed that the instrument may cause a deflection of the compass needle the following procedure is suggested to surmount this difficulty.

(h) The observer takes magnetic readings at a fixed distance at 45° intervals about the instrument. The needle will show a maximum opposite variation on the eastern and western positions and zero variations or a change in sign on the north and south positions on the magnetic meridian. This is illustrated in Figure 2.

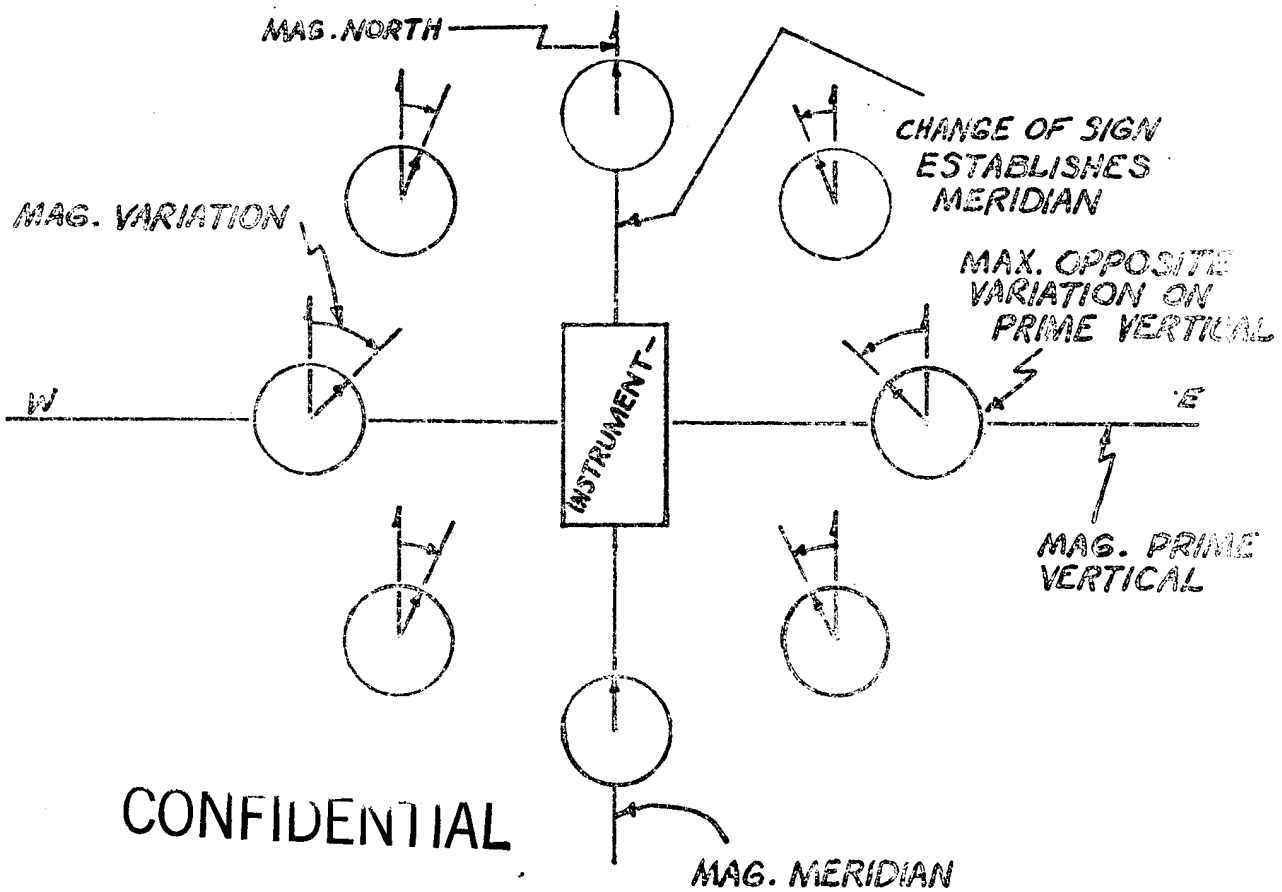

FIG. 2

This procedure may be used whether the instrument and compass are an intregal unit or two separate items.

B. Geographic System.

1. Equipment

(a) Map

(b) Aiming circle

(c) Protractor

2. Procedure

(a) Select positions to be occupied on map and connect positions with a straight line.

(b) Select a point positively identifiable from each position. This may or may not be the same point.

(c) With a protractor measure off angle on map at each position between reference mark and opposite station.

(d) Identify reference mark in the field and aim circle clockwise to given angle i.e., angle obtained with protractors. This is illustrated in Figure 3.

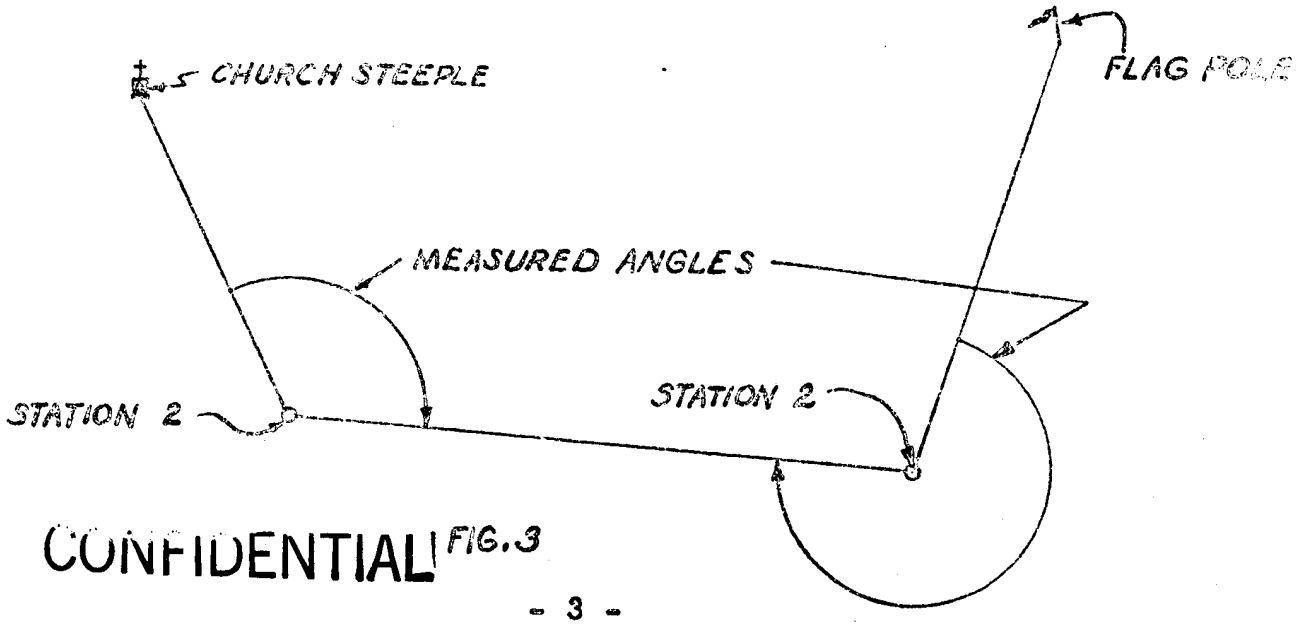

FIG. 3

C. Star Graphic Method

1. Equipment

(a) Map

(b) Aiming circle

(c) Star Almanac

(d) Protractor

(e) Wrist watch

2. Procedure

(a) Select positions on map and interpolate latitude and longitude; also with a protractor measure off angle at station between true north and opposite station.

(b) Compute local sidereal time of both positions.

$LCT \pm = GCT + GST^{oh} + GCT\ corr \pm = L.ST.$

(c) Plot position of station on graph paper using the latitude value as declination (S) and the L.ST. as the Right ascension (RA). The abscissa is RA. and the ordinate .

(d) Draw two circles using the plotted position as center - one circle to have a radius of 70° and the other 45°. These circle represent the zenith distance from observer. This is illustrated in Figure 4.

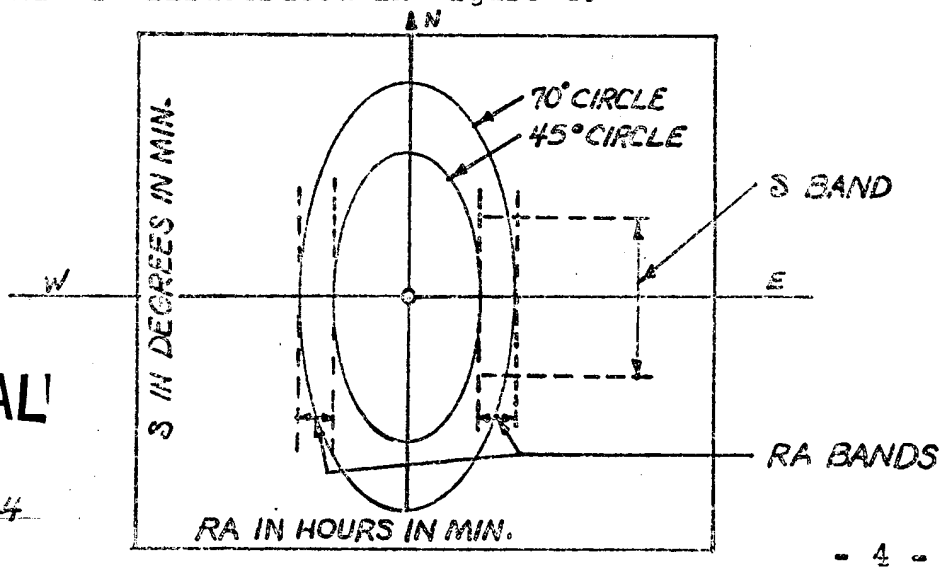

FIG. 4

(e) Select the limiting and RA falling between the 70° and 45° circles. East and west stars are preferred. Figure 4.

(f) From star almanac select first magnitude stars that fall within the desired and R.A. bands.

(g) Plot the positions of desired stars on the same sheet of graph paper. More than one star is selected to insure a choice of stars for positive identification while in the field. A straight line is drawn from station to each star. The angle between north measured clockwise to the star is the azimuth of the star, Figure 5.

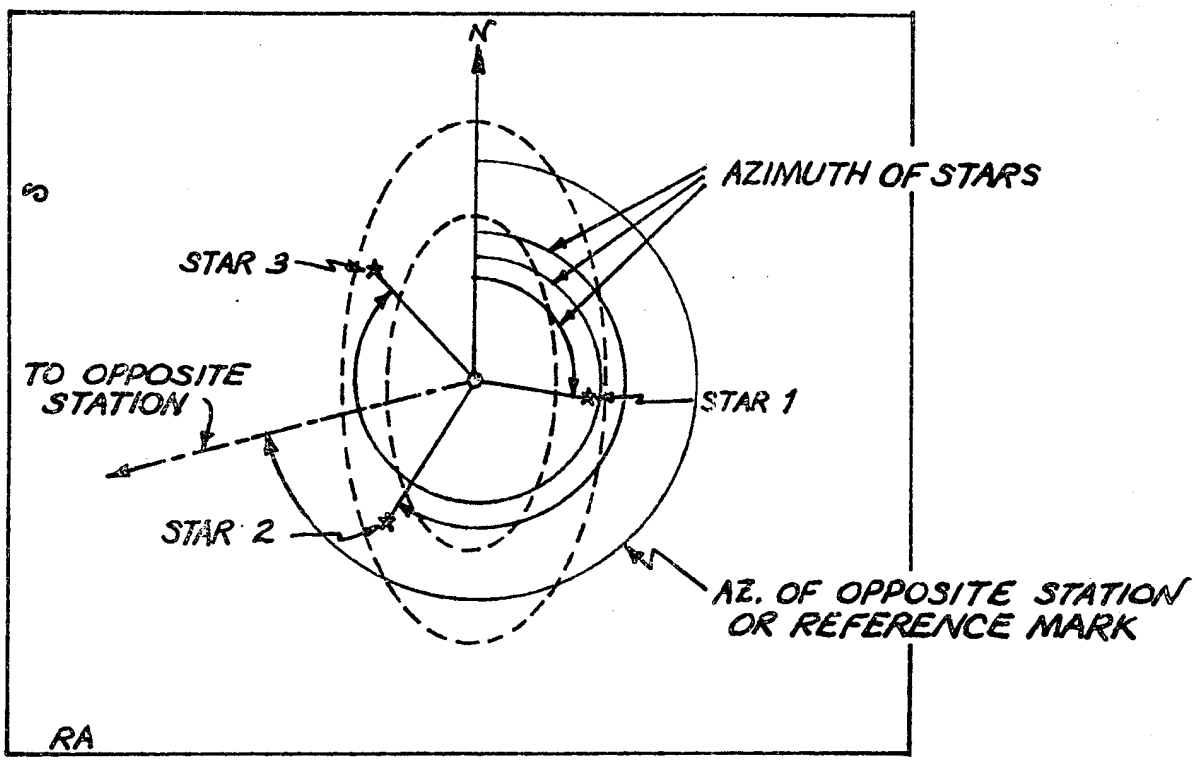

FIG. 5

(h) Plot angle to opposite station on reference mark on graph paper. Figure 5.

(i) It is desirable to make more than one observation on a star to assure consistancy of observation. Plot position of station for five minute intervals on graph paper. Figure 6. Measure all angles with protractor

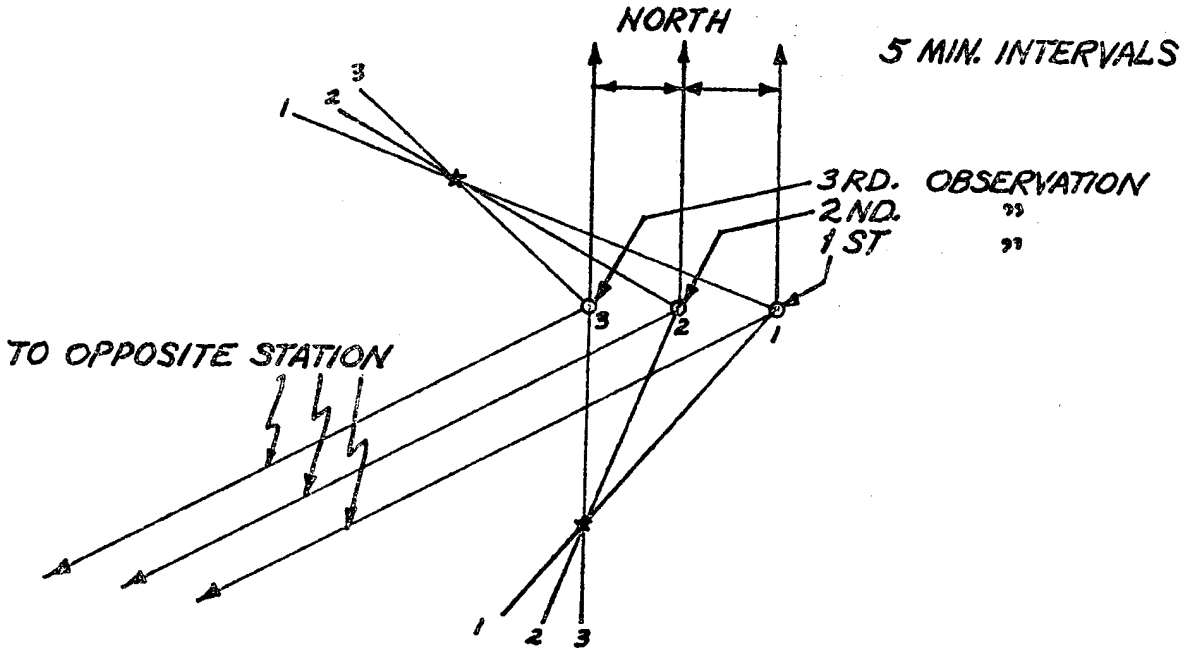

FIG. 6

(j) In the field the observation consists of pointing with an aiming circle at the star selected at the precise L.S.T. and recording the horizontal angle to the opposite station or reference point. The horizontal angle plus the stars azimuth is equal to the azimuth of the station deduced clockwise from north.

D. Field Test.

1. Magnetic Azimuth System.

(a) On two field tests the difference between magnetic

azimuth and azimuth obtained from map was 25 minutes and 50 minutes respectively. The difference between magnetic azimuth and theodolite measurements was 15 minutes.

(b) The test for magnetic effect on instrument was as follows:

Position	Compass Reading	Deviation from Average
0	39.0°	0
1	41.5	+2.5
2	43.0	+4.0
3	42.5	+3.5
4	39.25	+0.25
5	35.0	-4.0
6	34.75	-4.25
7	37.25	-1.75
Average	39.0°	

Reading without instrument in vicinity was 39.0°; so there was no error in the field test of the magnetic effect of the instrument.

(c) Geographic System

(1) The error between measured map values and observed values with amming circle was 40 minutes.

(d) Star Graphic Method

(1) The error between the angle measured on the Plot and the angle measured with an aiming circle was 25'.

E. Optical System

Preliminary analysis demonstrated that an optical technique could not be accomplished without complicated, expensive optical instrumentation, skilled observers and an obvious disclosure of the orientation procedure to those in the area not relevant to the communication.